

# Time symmetric Go

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## 1 Introduction

The game Go is an ancient and highly interesting game of local to global geometric principles, with a very large diversity of possible game states. For the most part it also has transparent, simple and beautiful rules. I say for the most part because like all turn based games in existence it suffers from time asymmetry between black and white players. In Go this is somewhat addressed by a rather ad-hock and inelegant rule called *komi*: whereby the white player which moves second is given a specific point advantage.

But the trouble of time asymmetry goes deeper than one inelegant rule. It results in counter-intuitive local pathologies in game states, for example *Ko* situation, where after a capture of a stone the opposing player may immediately recapture, but is forbidden by an extra ad-hock rule, to avoid an infinite loop situation. Another example is that of *Seki* or local stalemate situation, which are not very exciting, and may shut down both players' global strategy. I won't go further in examining time asymmetry in Go, since the main purpose of this note is simply to introduce another interesting possibility.

We are going to introduce a time symmetric version of Go, or S-Go for short, which solves the above issues, while at the same time fantastically expanding the allowed number of game states. Indeed it is remarkable that this can even be done, as time symmetric version of chess seems unimaginable. The idea for the time symmetry that we introduce is inspired by quantum mechanics, augmented by the objective reduction ideas of Roger Penrose in the context of quantum gravity, [1]. But not to scare the reader: the game is still very simple, transparent and deterministic, in the sense that the game state is completely determined by the action of the players, (there is no dice). Equally importantly, existing Go programs can be easily modified for S-Go, and it is even possible to play on a physical board, although as we shall see it may be a bit cumbersome.

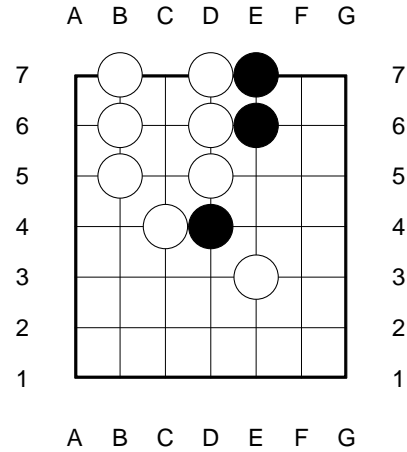
## 2 Game rules

The game is played on a standard Go board, with two players that we call black and white. As in Go both players move by placing a black or white stone on the board, but in S-Go they do this on the same turn without knowledge of the others move.

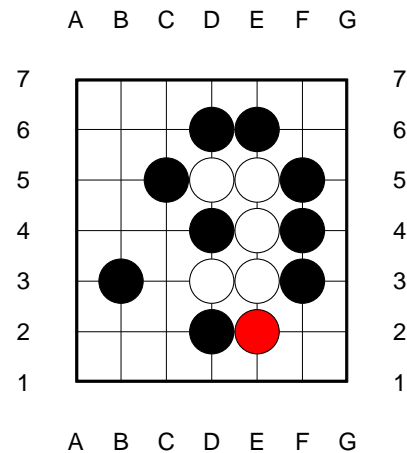
The first rule of S-Go, is that if the players place stone in the same position a red stone is instead placed there. A red stone is both white and black, and becomes plain white or black the first time (including the present turn) it is used to eliminate liberties of a group of black respectively white stones, (i.e. used to kill the corresponding group). Also, a captured red stone is to be replaced by a plain black, respectively white stone if captured by black, respectively white player.

Chessboard diagram showing a position after White's 10th move. The board has columns A-G and rows 1-7. White pieces are at B7, C7, D7, B6, D6, B5, D5, C4, and E3. Black pieces are at E7, E6, E5, and D4. The king is at E7, and the queen is at E5.

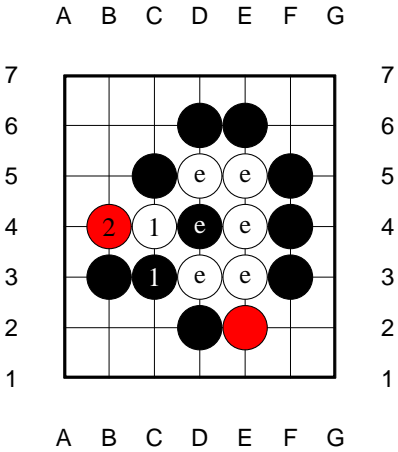
One more note on this example are in order. If black also moved to C7 on turn 3, this is counted as suicide by black as he eliminated liberties of his own group, using the red stone at C4. Our convention here is that the stone at C7 is white prisoner and is removed with the other 2 stones. This results in position on the right.



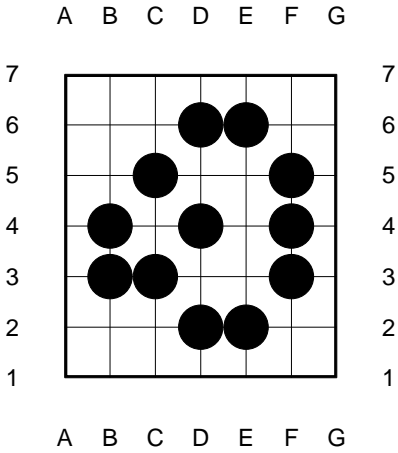
Let us consider another possible indeterminate state and explain the other main rule of S-Go. In this position white attempts capture at C4, while black attempts capture at C3. The second rule of S-Go states that under simultaneous capture situation of black and white groups neither group is captured when the two groups reduce each others liberty. The groups that would be captured are left in place and marked (say by e standing for entangled). We see this below.



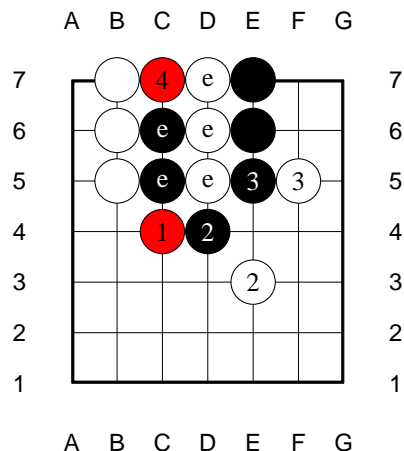
Both black and white groups remain but are now labeled by e. The fate of these groups is resolved by the same principle as the fate of red stones: the next time white e-stones are used in killing a group of black stones, (but not the black e-stones they are entangled with) they are replaced by plane white stones, which often means capture of a group of corresponding black e-stones, and vice versa. Here the position becomes completely resolved to a classical Go state, on turn 2.



Resolved position after turn 2.



We give one last example to explain a slightly different manifestation of rule 2. Suppose white in the first example plays more recklessly with F5 on turn 3. Since black and white C7 are both killing moves, we get an interesting indeterminate (unresolved) game state on the right.



### 3 End of the game

As in Go, S-Go game ends after both players pass. At which point the winner is decided as in Go by territory and prisoner count. A tie is now possible although unlike chess it is exceedingly unlikely, (on a typical  $19 \times 19$  go board).

### 4 Concluding remarks

As we see S-Go solves the problem of asymmetry, and introduces even more variety and complexity into game states. The cost of this is that since the opponent's move is not immediately known, there is some uncertainty in the game, although in some situations decisive winning strategies are still possible; as the game state evolution in S-Go is deterministic, taken as a whole system with 2 players.

I argue that this actually makes the game more intuitive since in real world conflicts, military or economic, actions by parties are often simultaneous for all practical purposes because of "fog of war".

On a side note, while S-Go is time-symmetric, unlike Go, positionally symmetric game states are fantastically unlikely: players cannot shadow each others moves, as sometimes happens even in higher level play in Go.

### References

- [1] Penrose, Roger (1989) *Shadows of the Mind: A Search for the Missing Science of Consciousness*. Oxford University Press. pp. 457. ISBN 0-19-853978-9.